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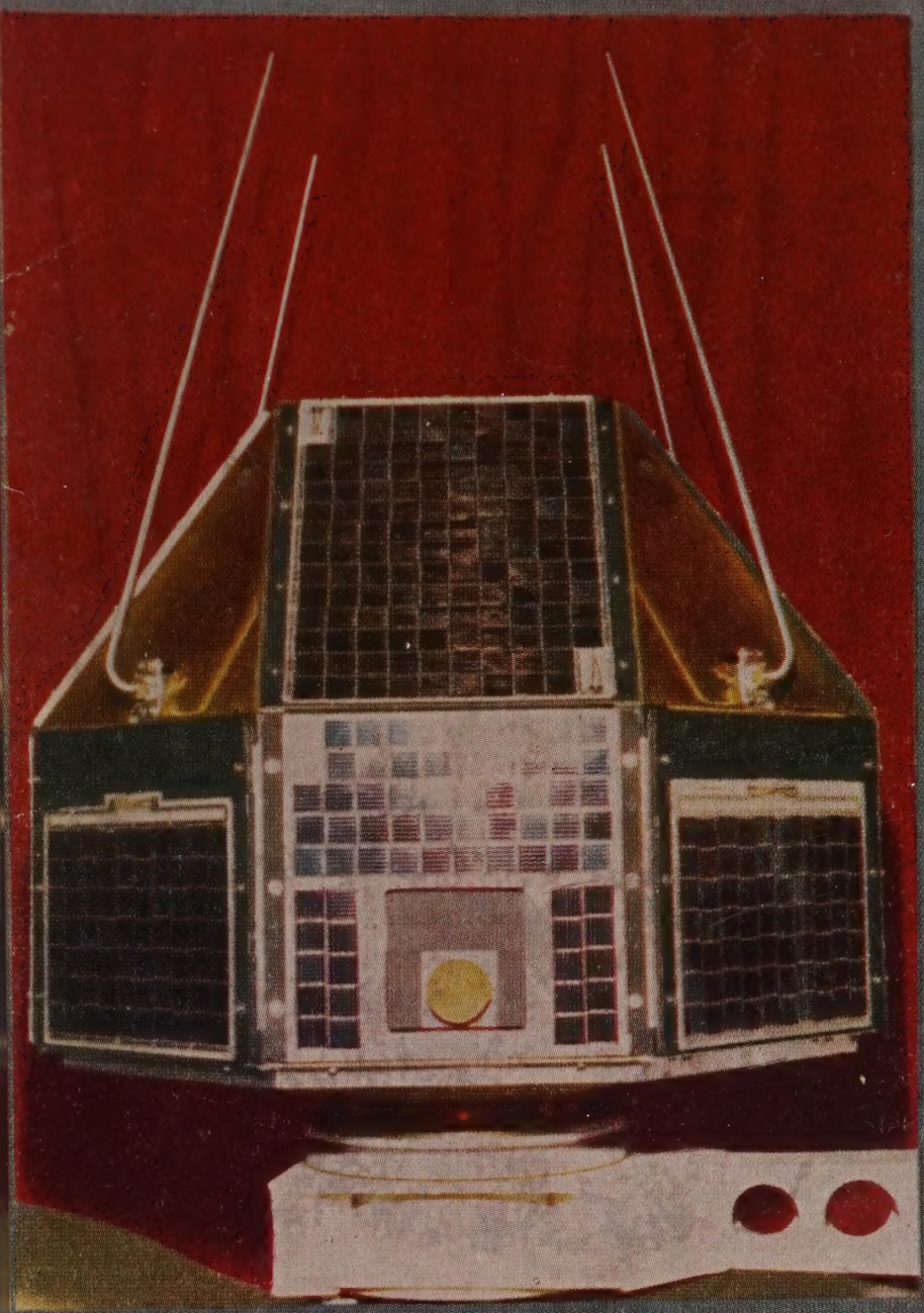

INSA NEWSLETTER

INDIAN NATIONAL SCIENCE ACADEMY NEW DELHI

In the words of the Prime Minister, Shrimati Indira Gandhi, *"the successful launching of SLV-3 and of Rohini-I is a notable achievement of Indian Science."*

The cover of the current issue shows the SLV-3 and the Rohini Satellite-I (RS-I). The statellite was designed and developed by ISRO Satellite Centre (ISAC), Bangalore. This technological satellite, integrated and tested at ISAC, was launched by the indigenously developed SLV-3 launch vehicle from ISRO's SHAR Centre in Sriharikota on July 18, 1980. The Satellite primarily evaluates performance parameters of the fourth stage of SLV-3 and the satellite performance in orbit is studied to obtain inputs for application in future scientific and technological mission. Evaluation of solar panel fabrication technology and evaluation of Indian solar cells is also one of the mission goals of RS-I. The satellite is making one orbit around the earth every 97 minutes. The maximum height of the satellite orbit is around 900 km with the minimum height being around 300 km.

The development work done for SLV-3 will have a direct impact on India's future space programmes. The fourth stage of the vehicle which is made of fibre-glass will form the apogee boost motor for the APPLE space-craft, India's first experimental Communication Satellite. APPLE will be flown on the third developmental flight of ESA's Ariane Launch Vehicle (by end of 1980 or early 1981).

Courtesy : ISRO.

The *INSA Newsletter* is issued by Dr J. N. Nanda, Executive Secretary.

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Nutrition Policy in the Successive Plans – A Critique*

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The paper examines the premises underlying the nutrition policy in successive plans and concludes that they are based on wrong understanding of the nutrition concepts. By far, the greater part of the funds for improving the nutritional levels of the people is spent on feeding programmes, especially school meals. These programmes have failed to show any impact in the past primarily because they are not supported by sanitary inputs and further, addressed at the wrong point of time in the growth of child. The way to improve levels of living nutrition status in particular is to develop social and economic action through community measures. Examples of such community projects are given in the paper.

RAISING the level of nutrition of the people is among the primary responsibilities of the State and has been specifically mentioned in Article 47 of the Constitution. Successive plans have accordingly attempted to develop a nutrition policy to translate this directive principle of the Constitution into action. However, the goal continues to elude us despite planned efforts over the last 30 years. Some 250 million people are estimated to live on inadequate diets for want of income. Such is the scale of under-employment and malnutrition in the country to-day.

The principal findings and premises on which our nutrition policy over the years is based can be summarised as follows :

(i) Our diets lack good quality protein. Unless the deficiency is made good, *'our economic, social and physical development will be completely arrested.'*

(ii) Undernutrition and malnutrition are widespread. The Planning Commission places the incidence at some 40 per cent.

(iii) The most vulnerable are the infants, pregnant and lactating mothers, pre-school and school-going children. Most of the damage done at this age to the physical and mental development is said to be irreversible.

(iv) While inadequate income is undoubtedly a major cause, it will take a long time to raise incomes to a level to ensure that the poor will be able to improve their working capacity and find work to be able to afford a diet that is nutritionally adequate. Efforts to raise income must, therefore, be supplemented by special feeding programmes for vulnerable classes.

(v) While protein-calorie malnutrition is a major problem, those of A vitaminosis, anaemia and goitre are also widely prevalent. Special programmes to combat them must also be instituted.

(vi) Finally, protected supply of drinking water is lacking in most villages and public health and sanitation are also inadequate. The synergism between resistance to infection and nutrition is recognised and reinforces the need for strengthening nutrition programme.

The statement on nutrition policy in the Draft of the Sixth Plan reviews the progress made and concludes that the impact so far made on the nutrition status of the people is little. It suggests measures to strengthen the programmes in force. It will be my attempt to pin-point attention to the basic weaknesses of the premises enumerated above, stress the need for reorientation of the policy and spell out its essential elements.

It will suffice my purpose if I take you to the years preceding the first United Nations Conference on Science and Technology of the last decade. Then, as now, people began to do some hard thinking on the problem of food and nutrition. There was particular reason to be optimistic at that time; man had just landed on the moon and this remarkable feat had given rise to a wave of optimism that given big science-based-technology and capital, we could conquer the problem of hunger and malnutrition facing the Third World. Accordingly, a committee on the application of Science and Technology to Development was set up by the United Nations to study the problem. This Committee was of the view that protein deficiency lay at the heart of the problem

*Based on a lecture delivered by the author at Madurai during the INSA General Meeting held in August, 1979.

of malnutrition, that foodgrain diets provide no more than 2/3rd of the protein needed by man, that if we continue taking it as it is without enriching it with good quality protein, our 'economic, social and physical development will be completely arrested', that it will take a long time at current rate of development for us to produce good quality animal protein and that even if we produce the needed animal products, most people will not be able to afford them. The only feasible solution in the Committee's view was technological. Modern technology, the Committee observed, had fortunately made it possible to produce new protein products which can be had at little extra cost. All that was needed was capital from the developed countries to back the effort and cooperation of the poor countries in distributing the protein so produced. Briefly, the Committee dismissed the problem of malnutrition as entirely technological in nature, requiring capital from the rich countries and cooperation of the poor.

Examination of the Committee's report, however, showed that there was little or no support for the thesis advanced by the Committee. In particular, it was found that the concentration and quality of protein in the cereal-pulse diet that we eat is more than adequate to meet man's needs provided he eats enough to meet his energy needs. For children, milk is a desirable addition, but not so much because the diet does not meet his protein needs but because it provides vitamins and minerals, especially calcium, and further, milk helps transition from breast milk to solid food. Even mother's milk contains no more than 5 to 6 per cent of its calories in the form of protein and yet it is an ideal food for infants. It is of course true that the food grain diet is not adequate for a satisfactory growth of laboratory animals like rat; 'but man is not a rat.' The relative rates of growth in man and rat are very different. As Mickelson puts it, '....if the results of bio-assays on rats reporting protein efficiency ratios were directly applicable to man, we would have never grown to adulthood.' There are no known benefits from excess consumption of protein either. On the contrary, at very high doses of N, the adult organism is found to be under stress, protein metabolism is altered, becoming more rapid in an effort to eliminate excess nitrogen as quickly as possible. If people in the rich countries eat more protein than what is needed for health, it must be because it is difficult to resist the temptation to eat more of tasty animal foods when one can afford to do so. Good nutrition is not only a matter of balance between intake and output; it is also a matter of the power with which balance is regulated. This regulatory power is over-strained at high doses of intake. For us in the developing countries, the real problem with protein arises from the inadequacy of the calories in the diet. Protein synthesis is very expensive in terms of calories. Available data, critically examined, has confirmed that protein malnutrition where it occurs is for the most part, the indirect result of inadequate energy in the diet.

Although the view that the limiting factor in our diet is energy and not protein now generally prevails, our nutrition programmes continue to use and emphasise protein rich foods to combat malnutrition. It is apparent that we are under pressure from the food industry to popularise protein-rich foods. The development of the lysine fortified bread is the direct result of this interest. Likewise, production of protein-rich biscuits, chocolates, drinks and infant foods, although mostly catering to the demands of the well-to-do, is carried out in the name of reducing malnutrition. It is likely that food technology in India will be extended in the years to come to cover even a larger variety of convenience and luxury protein-rich food articles as in the West. While all this is understandable, it will be wrong to encourage the belief that these products and feeding programmes based thereon are a solution to our nutrition problem. The use of colourless, odourless and tasteless amino acid powders to enrich the content of protein to prepare new food articles for use in nutrition programmes e.g., *sukhadi* has little to command in practice. A glass of milk in their place will be far more beneficial for health.

Analysis of data confirms that as income increases, the energy intake increases, rapidly to start with and gradually thereafter, indicating that an appreciable number of people remain undernourished and hence malnourished for want of adequate income. Our planners were quick to see in this analysis that poverty was the principal reason for the large and widespread incidence of malnutrition as also for its persistent nature over the years. It followed that the policies and plans to combat malnutrition, which hitherto look as a first reference point of attack of the existing inequalities in protein consumption, must give way to policies and plans to eliminate inequalities in the income itself, at least to enable the poor and the malnourished to have income to afford a cereal-pulse diet adequate to meet their energy needs. The emphasis on providing employment to the needy, even guaranteeing it, was born out of this realisation.

While there is no doubt that we are on the right path in emphasising employment as the most essential element in combating malnutrition, we have not done sufficient homework in understanding what minimum energy need means and how we should go about in defining minimum income to afford it. The view that inadequate income is the cause of widespread

malnutrition gained such rapid acceptance that minimum energy requirement has now come to be used as the criterion for estimating the extent of poverty itself. A person, who cannot afford a diet which meets his minimum energy needs, is certainly both poor and malnourished. The oft quoted figures that some 40 per cent of the rural population and 50 per cent of the urban population of India are poor and malnourished are arrived at using this criterion. More recently, Reutlinger and Sellowsky of the World Bank have also used this criterion to estimate the dimensions of malnutrition and poverty in the developing world. However, in estimating the poverty in this way, the authors have misused the meaning of energy requirement. They have used average energy requirement for the minimum and in the process grossly overstated the dimensions of hunger and malnutrition. These studies remind me of the report made by the late Sir Arther Bowley for United Kingdom in the thirties. He found that 50 per cent people in the U.K. ate below the average requirement for Great Britain and concluded (to the consternation of the Ministry concerned) that they must be undernourished and malnourished. The Government rejected the report.

In our country, however, our planners are holding fast to the meaningless figures for the incidence of poverty and malnutrition arrived in this way. They are meaningless because to call a person as undernourished when his intake is below the average is equivalent to considering a person as overnourished when his intake exceeds the average requirement. This would imply that the more serious problem with India today is overnutrition, not undernutrition. One is bound to reach such an absurd conclusion when one uses statistical methods without paying adequate regard to inter and intra-individual variation in intake and requirement.

How does one take into account the variation in estimating the incidence of undernutrition? A consideration of this question will take more time than would be desirable to devote in this paper. It would suffice here to state that energy balance in maintaining body weight is found to vary from day-to-day and week-to-week in a way that is far from random. In particular, the successive values are found to be corrected in an autoregressive (AR) process showing that the balance is regulated. It would also appear that as the individual advances in time living in a specialised environment on fixed intake, maintaining body-weight, the genetic component interacts with the environment to keep the variance constant. As a result, intra-individual variation remains a fundamental source of variation even when intake and expenditure are averaged over a week. This means that there is no absolute energy requirement for any day or period. It simply means that the individual is in homeostasis and that his requirement is controlled by a regulated system. This is also the explanation of why intakes of individuals belonging to the same age-sex group and engaged in similar activities are found to vary over a wide range even when intakes are averaged over a week (Widdowson, 1947). In partiular, Widdowson observed that one can be sure of finding two individuals in every 40, one of whom has an intake twice as large as that of the smallest eater and yet all are healthy and active, doing similar work. A part of this variation will undoubtedly be due to variation in body weight. However, the correlation between body weight and intake rarely exceeded 0.5 Even after standardising intake to reference body weight, it was observed that individuals differed in their weekly intakes with a coefficient of variation of 12 to 15 per cent. Evidently, body regulates its energy balance by varying the efficiency of utilisation much in the same way as it regulates N balance. Although the mechanism of the theory is not known, metabolic pathways which lead to variation in energy balance are known. In consequence, we cannot regard an individual eating less than the average requirement as necessarily undernourished or one eating above the average as necessarily overnourished unless his intake is found to exceed the homeostatic limits governing the auto-regulatory mechanism of his energy balance.

I have referred to these overestimations because policies and programmes based on cut-off points for income corresponding to the average energy requirement can be self-defeating. When correct meaning is put on requirement and allowance is made for intra-individual variation, it will be found that at best 15 to 20 per cent of the population can be considered as malnourished for want of adequate income. The National Sample Survey (NSS) data do not show individual intakes in a household and hence do not lend themselves to a more precise statement of incidence by age and sex. Clinical evidence shows that the incidence is smaller. Even a figure of 15 per cent, however, means that some 15 to 20 million households do not have income per capita adequate to meet the energy needs of the household. Poverty and malnutrition are hard realities but by including twice or thrice as many individuals as poor and malnourished when only the lower half or third among them are so, we are only helping the relatively better offs among the poor with an opportunity of capturing the benefits of official programmes, leaving those who are really poor as they were or even to become worse. There

is thus not only a misallocation of resources away from the needy but a large wastage of funds without having economic-development-generated resources to pay for them.

The third premise of the national nutrition policy is that the baneful effects of malnutrition in early life cannot be remedied in later life and that therefore nutrition intervention programmes must be addressed to cover the most vulnerable groups namely, infants, pre-school and school children. No one can find fault with the first part of the above statement but it does not justify that nutrition programmes should have for their concept of target all vulnerable groups upto 14 years, nor the concept that every child within the vulnerable group should be covered regardless of distinction between the needy and not needy. Economic and social implications of such policy measures are too serious to be ignored. If the baneful effects of malnutrition are to be arrested, we must address nutrition intervention programmes at the right point of time in the growth of child.

Until about six months, breast feeding protects a child from infections and ensures a growth curve similar to that of the 'reference' child. However, at about the weaning time, the growth curve begins to deviate and the gap in stature widens with age. At about the age of 3 to 5 years the gap stabilises, the child adapts itself to local ecology and the growth curve becomes almost parallel to that in the developed countries. Clearly, the period of intervention is the period from 6 months to 5 years at the outside.

It is during this period that a child is exposed to repeated episodes of diarrhoea and other gastro-intestinal diseases, energy and nitrogen balance is lowered and body growth is adversely affected. Little can be done in later years by way of interventions to correct this situation. On the other hand, if a child is protected against exposures to gastro-intestinal infections and/or effectively treated, he grows much like a healthy child from a developed country. It follows that intervention programmes should be so devised as will help in eradicating the causes of morbidity in children particularly diarrhoea. One may ask why diarrhoea? The reason is that it is the *sine qua non* of poverty. More than any other diseases, diarrhoea is found responsible for most of the morbidity in children.

It is difficult to identify and reach the children below five. But reaching every child is not necessary at this stage of development in the country. Small stature is not caused by small intake alone but is the result of high morbidity rates. It is, therefore, important that the children are protected against diarrhoea, gastro-intestinal and other diseases. Such protection calls for public health measures. I am not against individual care and feeding. We have provided for it in ICDS programmes with their excellent infrastructure of health services, but these programmes cannot take us very far. What we need is a public health model to ensure that every village or community therein has an access to protected supply of drinking water, water for washing and maintenance of hygiene and improved sanitation. Further, we need to bring up children in their use in the course of education at school. There is ample evidence to show that if we did this, the child will respond rapidly and improve in stature almost to the level observed in children in households enjoying high economic status as in U.K. and U.S.A. There is no synergism worth depending upon between nutrition and resistance to diarrhoea. A well-nourished individual is as susceptible to *E. coli* and other pathogenic bacteria causing diarrhoea as a malnourished child. Good nutrition may reduce the duration of illness but there is no evidence that it will reduce prevalence. Diarrhoea can worsen malnutrition however.

There is thus no case for feeding programmes for school children upto 12 and 14 years that the VI plan has provided for in the draft policy statement. I am not against them but I would not give them priority because evaluation showed that school meal programmes have failed to make any impact on the height and weight of children. Apparently, once the opportunity of rapid growth is lost in the first three years, it cannot be made up later particularly in characters whose expression is genetically influenced. Such programmes should be started and sustained in tribal and drought prone areas where the incidence of hunger and poverty is the highest. But even here water for drinking, for washing, and for farming should be given higher priority.

The fourth promise of the national policy is a statement of fact based on experience of the last 20 years. In the 1960's, it was thought that as GNP increased, the incidence of hunger will be reduced. This did not happen. Direct interventions were thought to be the answer but they too have failed. Far from improving work productivity and stature and reducing morbidity and mortality they have only helped to create a sense of dependency for food thus striking at the very root of the value of dignity so characteristic of human life. As already stressed, a greater weakness arose from the failure of the programmes to distinguish between individuals who needed assistance and those who did not. This was inevitable in an approach which aimed to cover all individuals of the 'vulnerable' groups. There is only one answer. Unless the programmes can be reorganised as to develop self-reliance in the needy, they

cannot be expected to contribute to reduction in social deprivation and hunger.

Fortunately, we now have considerable experience to show that the needy and malnourished, even children, can be actively involved in generating social and economic action in eradicating the main causes of hunger and malnutrition. Indira Community Kitchen at Poona and the Village Programme in Kitketwadi provide examples of the effort. Description of these programmes is given elsewhere (Sukhatme, 1979) and is reproduced below for convenience of the reader.

"The employees of Indira Community Kitchen are drawn from backward classes in need of employment. It is a cooperative. The food articles prepared are what we eat at home—poli (wheat roti), bhat (rice), bhakri (jowar roti), varan, vegetables and sweets. The tools used in preparing them are the same that we use at home and yet the productivity of our workers is sufficiently high so as to convert the input of Rs. 20/- into Rs. 30/- a day, thus leaving up to Rs. 10/- with which to pay a worker and provide for the health and other services. We are able to sell our products at prices which are 50 per cent lower than the market price. For example, chapaties are sold at Rs. 4/- per kilo though the market price for comparable quality is twice as high. As for nutritional content, I would refer you to the tables in the *Annual Report of the Indira Community Kitchen*. You will find that the Kitchen is able to give a meal of some 1200 calories at Rs. 1.50. This means that the Kitchen is able to meet the daily needs of an adult man at Rs. 3/-.

"As for quality and taste of the food we offer, I would refer to the opinions of the people who have visited us. I myself occasionally take meals from the Kitchen and find my guests complimenting my wife for the foods served when in fact the meals have been prepared by the Kitchen and served hot at home."

"How is it, you may ask, that the Community Kitchen is able to offer the articles so cheaply. In the beginning our employees were not able to prepare more than 5 or 6 bhakries an hour. By improving the supervision and management and by developing human skills of the employees, the rate of productivity has been increased to 30 bhakries an hour. I would rather invite you to visit us to see for yourself what we have been able to achieve by dividing the total operation into sub-operations—sieving, cleaning, preparing dough, rolling, baking on the gas range until one layer is formed, baking on coal-hearth for the formation of the other layer, drying, packing, etc. The whole operation has a human touch and yet it is carried out with the efficiency of an assembly line in a factory. Our Kitchen illustrates how labour intensive technology can be used in offering guaranteed employment at market wage rate by keeping the marginal productivity sufficiently high. Since our activities are primarily labour intensive, investment of capital is small. We are able to employ a worker by investing Rs. 1500/- per worker only."

We serve about 7000 people a day and the demand for our foods continues to be heavy. We plan to increase the services to cover more people and simultaneously increase employment of women who are primarily drawn from the weaker sections of the community. As we expand, we are sure we would be making a decisive impact on the economy. Although food is the dominant need, of equal importance are other aspects of the lives of these people, e.g., housing, hygiene, education and nutrition of children. To provide employment disregarding these aspects is to lose the opportunity we have of bringing about a social transformation in the lives of the poor. As soon as we shift the Kitchen to the new land, we shall set up Anganwadi within the compound of the Kitchen to collect the children of those who work with us and arrange for their feeding and schooling. This will ensure the link between mothers and children that is lacking today in the government sponsored nutrition programmes which aim at delivering packets of food in the hands of children standing in a queue. The psychological impact we expect will be a great asset in improving the nutrition status of the child.

In cities, there is a ready market for prepared foods, but not in villages. We are, therefore, experimenting along different lines in villages. Our work in villages is centred around schools and is divided into three stages. The first stage is directed to the improvement of the campus. This we have found a relatively easy task once the cooperation of the school authorities and the Zilla Parishad is secured. Simultaneously, we have concentrated on imparting health and hygiene education and fostering of community action. The second stage is directed to the construction of a bore well, community latrines adequate for use by all students and a bio-gas plant connected with the latrines. The aim here is to motivate children into using community latrines as the first thing in the morning, and taking a bath and daily washing of clothes as a matter of habit before entering the class. These habits, we hypothesise, will materially help in reducing the incidence of gastro-intestinal diseases. In the last stage, a supplementary nutrition programme will be started for breakfast and lunch. Our hope that once the children come to recognize the value and benefit of hygiene and sani-

tary measures for their well being, and particularly the value of recycling waste, they are likely to carry forward the habits so formed in later life, thereby serving as a catalytic agent to bring about social transformation of the community.

To only one need I must refer here and that is to the need to stimulate development of resources in the tribal and drought prone areas to ensure that seasonal variations do not adversely influence the levels of consumption of those who are under nourished for want of income. These are the areas most exposed to threat of hunger in times of scarcity conditions. Small farmers and landless labourers from drought prone and tribal areas need to be helped into achieving higher levels of production and productivity in a time-bound plan.

On premise (v), I would not like to comment because once the problem of undernutrition and underemployment is solved, these programmes will take care of themselves. In any event, distribution of tablets can never be a solution to the problem.

On premise (VI), no separate comment is necessary because I have already covered it in commenting on premise (iii).

Nutrition planners are coming out with new issues to explain the lack of success of nutrition programmes. This is increasingly reflected in the new and complex econometric models of holistic approaches to planning. This posture, if it may be so called, will need to be critically gone into. Already they have exaggerated the dimensions of hunger and malnutrition by distorting the meaning of concepts of nutritional requirement. The basic fallacy lies in the assumption that requirement is fixed and the more food one consumes the better is the nutritional status. There is no evidence to support these assumptions. We find that healthy human beings can regulate their body stores of energy and protein on a wide range of intakes without any implication that adaptation to a lower level within this range compromises one's health and physical development. A man is a homeostate; he functions as one whole; anything that disturbs his state of homeostasis sets in motion a series of reactions that overcome the disturbing factor. This is the meaning when we say that N and energy balance in man in health is auto-regulated. The power with which regulation is exercised is determined by the value of auto-correlation. This value decreases as the intake increases. Outside the range, the man is under stress; he may adapt or he may not. His behaviour needs profound understanding by social and economic planners before we can hope to have a sound policy for the country to improve levels of living and of nutrition in particular.

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ACADEMY NEWS

Council Meeting–March 1, 1980

Some important decisions of the Non-Statutory Council meeting held on 1 March 1980 are reported below:

Medal Lectures

The Council was of the view that all General Medal lectures should be taped and the Academy should have a Library of tapes. These tapes could be made available to various Research Institutions in the country for the use of scientists and specialists.

Representation of INSA on the Council of IACS

The Council nominated Professors C. N. R. Rao and S. K. Trehan as its representatives on the Council of the Indian Association for the Cultivation of Science, Calcutta, for the term 1980–81.

INSA Office in Calcutta

The Council constituted a Committee consisting of Professors M. G. Deo, H. Y. Mohan Ram, S. K. Trehan, C. N. R. Rao and A. K. Sharma to look into the recommendations made by the earlier Committee consisting of Professors H. Y. Mohan Ram, S. K. Trehan and A. K. Sharma regarding the working of the INSA Office in Calcutta and also the possibility of opening Regional Offices of the Academy in other parts of the country as well e.g., in Bombay, Bangalore and at other places.

Council Meeting–May 8-9, 1980

Some important decisions taken at the 2nd Statutory Council Meeting of INSA for the year 1980 held on 8 May 1980 at Kashmir University, Srinagar and the 9 May 1980 at the High Altitude Laboratory of Bhabha Atomic Research Centre, Gulmarg, are reported below:

Determination of Vacancies that will occur among Officers and other Members of the Council during the ensuing year (1981) as per rules of the Academy

The Council determined the vacancies of the posts of President, two Vice-Presidents, Treasurer, Foreign Secretary, Secretary (Biological) and six members of the Council.

First Selection of Names to be Considered for Election as Foreign Fellows

Considering the names of candidates that have been proposed for election to Foreign Fellowship, the Council expressed the decision that the INSA should include scientists from the neighbouring countries.

Nomination of INSA Representative at the 36th Annual Session of the Sri Lanka Association for the Advancement of Science

The Council nominated Dr B. D. Tilak to visit Colombo from 12–17 December 1980 to represent INSA.

Science Academy Medals for Young Scientists

The Council considered the suggestions made at the Joint Meeting of the Sectional Committees held on 21 April 1980 regarding the award of the *Science Academy Medals for Young Scientists* and *recommended that* :—

(i) Referee's report should be obtained in all cases and circulated to the members of the Sectional Committees along with the particulars of the candidates.

(ii) The meeting of the Basic Sciences Committee should examine nominations received under the category (M) miscellaneous, and assign it to different Committees for consideration.

(iii) In case recommendations are not received from all members of the Sectional Committees by the date prescribed, the Secretaries and President may on the recommendations of the Conveners decide on the calling of candidates who have obtained marginal marks.

(iv) According to the present regulations, the number of maximum awards per year is 15. In case if in any year some exceptionally good candidates are available it may not be necessary to restrict the awards to 15.

Recommendations of the Committee to consider Matters regarding Nominations for Awards/Lectures etc.

A copy of the recommendations as approved by the Council is given as *Appendix—I.*

Committee to consider the Present Grouping of Subjects under different Sectional Committees and make Recommendations as to how this could be extended to make the Fellowship more representative of all disciplines

A draft working paper on the present grouping of subjects under different Sectional Committees read out by the Executive Secretary was discussed in very great detail. The Council was generally concerned about the non-representation of various branches of science in the Fellowship of the Academy and about the consideration of nominations of those whose work is of an inter-disciplinary or multi-disciplinary nature. It may generally be a good idea not to specify the areas in detail for consideration under each discipline because such identification of topics tends to be restrictive in nature rather than an aid at elucidation. The broad subjects alone need be mentioned. The Sectional Committees could also reflect the expansion in technology and innovations. The Council constituted a Committee consisting of Professor R. C. Mehrotra, Dr Y. Nayudamma*, Professor M. M. Sharma, Professor S. K. Trehan, Dr Yash Pal, Dr M. G. Deo and Dr A. P. Mitra to examine in detail and in depth the present grouping of subjects under different Committees and make their recommendations as to how this could be extended to make the Fellowship more representative of all disciplines of science.

The Sub-Committee can go into the details of the whole process. First, the Committee will specifically address itself to the question whether there is a fairly balanced representation in our Academy of those fields of research endeavour which are important in which active work is going on in the country. The Sub-Committee will review the entire matter.

Voting Paper

The Council accepted the suggestion that the voting paper for election of Fellows in future will contain only one page with all the names recommended by the Council for election to Fellowship in columns where a cross can be placed for each candidate, and a blank column for any alterations desired.

Specialization and citation of the persons being recommended for Fellowship will be sent separately with the voting paper.

*Requested to be Convener.

INSA's Contribution to ICSU towards GARP

The Council desired to contribute $ 1000 p.a. to ICSU towards Global Atmospheric Research Programme (GARP) from January 1980 onwards. The adherence to this programme was decided at the last meeting of the Council and this is the minimum national contribution.

Indian National Committee for Immunology

The Indian National Committee for Immunology was constituted with the following members:—

1. Dr G. P. Talwar — *Chairman*
2. Dr Shobha Sehgal — *Secretary*
3. Dr M. G. Deo
4. Dr J. N. Monga
5. Dr V. R. Muthukkaruppan
6. Dr U. Sen Gupta

Celebration of the 1000th Birth Anniversary of Avicenna

Considering the recommendations made at the meeting of the National Commission for the Compilation of History of Science held on 25 March 1980, a reference was made to the forthcoming Commemoration of 1000th Birth Anniversary of Avicenna to be organised towards the end of 1980. Depending upon the number and quality of papers, the celebration could be extended to two days if necessary. Participation of experts from the USSR will also be welcome.

Symposium on R & D in Conservation and Management of Mineral Resources

A symposium on *R & D in Conservation and Management of Mineral Resources* may be held. The date and time will be announced later.

Venue of the Meeting of the Council and Ordinary General Meeting to be held on 7–8 August 1980

The Council decided that the above meetings be held at the University of Udaipur, Udaipur. In case there was any difficulty, the meetings may be held at the University of Rajasthan, Jaipur.

Visit of Professor Morris Cohen

Professor Moris Cohen, Emeritus Professor, Massachusetts Institute of Technology, Cambridge, Mass 02139, U.S.A. and Honorary Member, Indian Institute of Metals visited the Academy on 18 June 1980. He was formally admitted to the Fellowship of INSA.

Later in the evening, Professor Cohen delivered a lecture on "Materials in World Affairs" arranged under the joint auspices of the INSA and the Indian Institute of Metals (Delhi Chapter). Dr V. Ramalingaswami, President, INSA, presided over the lecture.

MISCELLANEOUS NEWS

January 25–31, 1981

International Symposium on Erosion and Sediment Transport in Pacific Rim Steeplands

The Symposium will examine four themes, each of which will begin with a keynote address and will be concluded by reviews and extended discussion. Approximately equal time will be given to contributed papers and to review and discussion. The themes are :

1. *Methods for assessing slope erosion and non-channel sediment sources in upland regions* : The relative importance of individual processes and sources, factors controlling erosion rates, process types and sources locations.
2. *Stream channel dynamics and morphology* : Sediment, supply-transport-deposition-storage interactions, estimation of sediment yields and delivery ratios, factors controlling channel form.
3. *Human impact on erosion and sediment yield in steeplands* : Effects of major land-management changes, comparison with natural time and space variations related to geologic, tectonic, or climatic processes, prediction of impacts based on case-study experiences.
4. *Impact and management of steeplands erosion*:
   (*a*) Impact of steeplands erosion on human activities—Effects of steepland erosion on downstream values, upland-lowland interactions, identification of system components where intervention provides the most effective control or modification of the fluvial system, on-site and off-site production, opportunities threatened by steepland erosion, cost-benefit analysis of protection of such opportunities, the spatial distribution of threatened opportunities in both lowlands and uplands.
   (*b*) Management of steeplands for erosion control—Specific techniques and their effectiveness, identification of "active" and 'passive" areas for water sediment supply, criteria for delineating protection zones of various types, costs and benefits of such zones, hydrotechnical planting.

Sponsors : The Royal Society of New Zealand; National Water and Soil Conservation Authority of New Zealand; International Association of Hydrological Sciences; New Zealand Hydrological Society.

Venue : University of Canterbury, Christchurch, New Zealand.

Correspondence to : Symposium Secretary, P. O. Box 737 Christchurch, New Zealand.

Population Education to be part of formal education

A notification issued in June 1980 by the Press Information Bureau of the Government of India states that concepts of population education are to be introduced in the formal system of education. The Government of India has approved a programme designed to ensure that the younger generation grows up with adequate awareness of the population problems and its responsibility in this respect.

The programme is estimated to cost Rs 4.26 crores during 1980–83. It involves the preparation of curriculum and material at the national and state levels and training of teachers and field workers. Material will also be developed for out-of-school children in non-formal education centres.

Formation of the Royal Society of Chemistry

The Royal Society of Chemistry (RSC), with the grant of its Royal Charter, has come into being on 1 June 1980 as a result of unification of the Chemical Society (CS) with the Royal Institute of Chemistry (RIC). The Royal charters of both the CS and the RIC have been surrendered and these have ceased to function as separate organisations. The Queen of England has granted her patronage to the new Society.

The RSC will have as its main objectives the advancement of the science of chemistry and its applications, and the maintenance of high standards of competence and integrity among practising chemists (as distinct from pharmacists). It will speak to Government and all sections of the community on behalf of some 40,000 scientists concerned with chemistry—as the CS and the RIC have done in the past—but it will do so with a single authoritative voice.

First Secretary-General of the RSC : Dr. John R. Ruch Keene.

First President of the RSC : Sir Edward Jones.

Enquiries to : Dr Ian Mc Kinley, External Relations and Recruitment Officer. (Tel. 01–580 3482).

(Address has not been finalised yet) contact address of the President of RSC : Waynflete Professor of Chemistry at the University of Oxford, Oxford, U.K.

Shanti Swarup Bhatnagar Prizes for Science and Technology of the CSIR for 1978 and 1979

The '*S. S. Bhatnagar Prizes for Science and Technology*' of the CSIR were awarded at a presentation ceremony by Smt. Indira Gandhi, the Prime Minister of India and President, CSIR on 25 July 1980 at 10.00 hrs at the NPL Auditorium in New Delhi. The following were the recipients:—

Physical Sciences

1978 : Professor E. S. Rajagopal, Chairman, Department of Physics, Indian Institute of Science, Bangalore

jointly with

Professor J. V. Narlikar, TIFR, Bombay.

1979 : Professor S. S. Jha, TIFR, Bombay

jointly with

Professor A. K. Ghatak, IIT, New Delhi.

Chemical Sciences

1978 : Professor Goverdhan Mehta, University of Hyderabad, Hyderabad

jointly with

Professor Girjesh Govil, TIFR, Bombay.

1979 : No award was presented.

Biological Sciences

1978 : Professor Viswanath Sasisekharan,Chairman, Molecular Biophysics Unit, Indian Institute of Science, Bangalore.

1979 : Professor A. N. Bhaduri, Jadavpur University, Calcutta

jointly with

Dr M. K Chandrasekharan, Madurai Kamaraj University, Madurai.

Engineering Sciences

1978 : Shri S. N. Seshadri, Head, Reactor Control Division, BARC, Bombay

jointly with

Professor D.V. Singh, University of Roorkee, Roorkee.

1979 : Professor P. Rama Rao, Department of Metallurgical Engineering, Banaras Hindu University, Varanasi.

Mathematical Sciences

1978 : Professor E. V. Krishnamurthy, Indian Institute of Science Bangalore.

1979 : Professor S. Ramanan, TIFR, Bombay

jointly with

Professor S. Raghavan, TIFR, Bombay.

Earth Sciences

1978 : Professor B. L. K. Somayajulu, Physical Research Laboratory, Ahmedabad

jointly with

Dr H. N. Siddiquie, National Institute of Oceanography, Goa.

1979 : Professor V. K. Gaur, University of Roorkee, Roorkee.

Minutes of the Meeting of the Committee to consider matters regarding Nominations for Awards/Lectures etc. of the Academy held at 10.30 a.m. on 23 April 1980 in the Indian National Science Academy

Members Present

PROFESSOR R. C. MEHROTRA
PROFESSOR R. R. DANIEL
DR A P. MITRA

The Committee considered the present method of inviting nominations for the award of Subject-wise Medals and Lectureships of the Academy and recommended the following :—

(i) Nominations in addition to being called for from the General Fellowship should also be called for from such institutions as are approved by the Council for that year. The Director-General, CSIR, and Government departments responsible for technical surveys etc. may also be requested to nominate candidates.

While calling for nominations, in the first instance, the proposers may be requested to indicate the major scientific achievements of the candidate in about 100 words.

This communication calling for nominations should also indicate the names of all the earlier recipients of the award.

(ii) The nominations received are to be examined by a Committee of the two Secretaries and any other experts they may wish to co-opt to prepare a short list. Detailed information on the scientific attainments including specific reference to outstanding contributions made by these short-listed scientists be then called for. This short list together with brief particulars of all nominations received should be circulated to the members of the Advisory Board six weeks before the date fixed for the meeting of the Advisory Board. Members may add to the short list prepared by the Screening Committee and request the INSA Office to collect additional information about such additional names. Members of the Advisory Board may also be requested to send additional nominations along with details one month in advance of the date of the meeting of the Advisory Board.

Minutes of the Ordinary General Meeting of the Indian National Science Academy held on 1 March, 1980 at 3.15 p.m. in INSA, New Delhi

Members Present

Dr V. Ramalingaswami, *President*
Professor R P Bambah, *Vice-President*
Dr A. R. Verma, *Foreign Secretary*
Professor S. K. Trehan, *Editor of Publications*
Dr M. G. Deo, *Secretary*
Dr A. P. Mitra, *Secretary*
Professor F C. Auluck
Dr Brahm Prakash
Dr B. Choudhury
DR A. K. Dey
Professor N. Gopinath
Dr S. S. Guraya
Dr S. C. Jain
Dr (Mrs.) Usha K. Luthra
Dr A. S. Paintal
Dr B. P. Pal
Dr R. Ramanna
Dr Satya Prasad Raychaudhuri
Professor K. N. Saxena
Professor M. S. Sodha
Dr S. Sriramachari
Dr P. N. Srivastava
Dr P. N. Tandon

Confirmation of the Minutes of the Anniversary General Meeting held on 31 January 1980

Confirmed.

Admission of Fellows under Rule 13

The following Fellows introduced by those indicated against their names were admitted to the Fellowship of the Academy under Rule 13. They signed the Register and received the Scroll certifying Fellowship :—

Name of the Fellow	*Introduced by*
Dr N. Gopinath	Dr S. Sriramachari
Dr S. S. Guraya	Professor P. N. Srivastava
Dr M. S. Sodha	Professor S. K. Trehan

To consider the Proposals for Amendment of Rules 5, 6, 19, 36 (iii), 37(a), 37(b), 38, 42, 51, 53(a), 54, 56(c)(iv), 56(c)(v), 58(a), 58(b), 59(c), 59(g), 60, 70 and 74

The General Body was of the view that more time should be given to the Fellowship for communicating their views on the proposed amendments to the various rules. A requisition signed by 11 Fellows was handed over to the President for convening an Extraordinary General Meeting for the purpose at a time convenient to the President preferably at the time of the Sectional Committee Meetings.

At the general discussion that followed, the following were mentioned :—

(i) It was suggested that Rule 58 was not very clear and amendment of Rule 58 may be examined.

(ii) Any major alterations/additions to the buildings of the Academy should be discussed by the respective Committees and should be approved by the Council.

(iii) Advantage should be taken of Book Fairs which are conducted in Delhi and the Library Committee should update the publications in the Library. It was pointed out that the INSA Library was of a highly specialised nature and it may not be necessary to duplicate the efforts of other Libraries in Delhi.

Presentation of the Shanti Swarup Bhatnagar Medal (1979) to Dr Brahm Prakash, FNA

The Shanti Swarup Bhatnagar Medal — 1979 was presented to Dr Brahm Prakash. Dr Brahm Prakash delivered his lecture on '*Metals and Materials Development for Atomic Energy and Space Programmes*' earlier.

Sd/-
A. P. Mitra
Secretary
8-5-1980

Sd/-
V. Ramalingaswami
President
8-5-1980

Minutes of the Extraording General Meeting of the Academy held at 3.00 p.m. on Tuesday *22* April 1980 in the Conference Room of the Indian National Science Academy, Bahadur Shah Zafar Marg, New Delhi

Members Present

Dr V. Ramalingaswami, *President*
Dr A. R. Verma, *Foreign Secretary*
Dr M. G. Deo, *Secretary*
Dr A. P. Mitra, *Secretary*
Professor H. Y. Mohan Ram, *Editor of Publications*
Professor S. K. Trehan, *Editor of Publications*
Dr S C. Agarwala
Dr (Mrs.) Archana Sharma
Professor F. C. Auluck
Dr M. K. V. Bappu
Dr D. S. Bhakuni
Dr P. M. Bhargava
Dr K. S. Bhargava
Dr V. G. Bhide
Dr B. B. Biswas
Dr B. Chaudhury
Dr R. R. Daniel
Dr J. S. Datta Munshi
Dr C. M. S. Dass
Dr Dinesh Mohan
Dr G. C. Esh
Professor P. N. Ganapati
Professor J. Ganguly
Dr N. C. Gangulee
Dr M. V. George
Dr Jagdish Shankar
Dr (Mrs.) Kamal J. Ranadive
Dr S. V. Kessar
Dr T. N. Khoshoo
Dr P. Koteswaram
Professor L. S. Kothari
Dr B. C. Kundu
Professor R. C. Mehrotra
Dr B. R. Murty
Dr K. R. Nair
Dr R. Narasimha
Dr N. A. Narasimham
Dr H. L. Nigam
Dr B. P. Pal
Dr C. C. Patel
Dr P. R. Pisharoty
Dr V. Puri
Dr M. R. Rajasekharasetty
Dr V. S. Ramadas
Dr R. Ramanna
Dr J. K. Sarkar
Professor K. N. Saxena
Professor A. K. Sharma
Dr A. P. B. Sinha
Dr U. S. Srivastava
Dr P. N. Srivastava
Dr C. V. Subramanian
Dr G. P. Talwar
Dr L. R. Vaidyanath

The President welcomed the members to the Extraordinary General Meeting and briefly narrated the reasons for calling this Extraordinary General Meeting and the constitution of the Daniel Committee for considering modifications in the rules and regulations of the Academy.

The matters were taken up for discussion.*

Clause by clause consideration of rules as they exist and modifications as proposed were considered.

Rule 5 : Accepted. It was decided that the location of the Asiatic Society i.e. Calcutta be specified.

Rule 6 : Accepted.

Rule 19 : Accepted.

Rule 36(iii) : Accepted.

Rule 37(a) : Accepted.

Rule 37(b) : Accepted.

Rule 38 : Proposed modification was amended to read : Each year six members of the Council not being the President, Vice-Presidents, Treasurer, Editors of Publications or Secretaries shall retire from the Council and shall not be eligible for reelection to membership of the Council until after the lapse of three years from the date of their retirement. The retirement.....unexpired period.

Rule 42 : Accepted.
Rule 51 : Accepted.
Rule 53(a) : Accepted.
Rule 54 : Accepted.
Rule 55(c)(iv) : Accepted.
Rule 55(c)(v) : Accepted.
Rule 58(a) : Accepted.
Rule 58(b) : Proposed modification was amended to read : Notice of the day and hour of the meeting, and of the special business to be transacted thereat, shall be given to Fellows within one month of receiving the request for the Extra-ordinary Meeting and before one month of the date of the Meeting, provided that .....within the meaning of this clause.
Rule 59(c) : Accepted.
Rule 59(g) : Proposed modification was amended to read : The voting on any question except when it be one of adjournment shall on the demand of any Fellow present, be postponed to the next ensuing meeting provided it has the concurrence of the majority of the members of the Council present.
Rule 60 : Accepted.
Rule 70 : Accepted.
Rule 74 : Accepted.

A statement of objections raised at the meeting is enclosed.**

The President thanked the members for being present and proposed a very special vote of thanks to the Daniel Committee consisting of Professors R. R. Daniel, V. Puri and Dr M. G. Deo for the work they have done.

Sd/-
(M. G. DEO)
Secretary

Dated : 08-05-1980

Sd/-
(V. RAMALINGASWAMI)
President

Dated : 08-05-1980

*The matter was discussed and on the basis of decision taken, the same was circulated as voting papers among Fellows. The voting papers were counted at the Ordinary General Meeting held at the University of Udaipur on August 8, 1980.
**The statement of objections has been circulated among Fellows and not given here.

Minutes of the Ordinary General Meeting of the Indian National Science Academy held at 4 p.m. on Thursday, 8 May 1980 at the Seminar Room of the Department of Zoology, Kashmir University, Srinagar

Members Present

Dr V. Ramalingaswami, *President*
Professor R. P. Bambah, *Vice-President*
Professor B. Ramachandra Rao, *Treasurer*
Dr A. R. Verma, *Foreign Secretary*
Dr M. G. Deo, *Secretary*
Dr A. P. Mitra, *Secretary*
Professor H. Y. Mohan Ram, *Editor of Publications*
Professor S. K. Trehan, *Editor of Publications*
Dr F. Ahmad
Professor G. K. Manna
Professor R. C. Mehrotra
Professor N. Balakrishnan Nair
Dr Supriya Roy
Professor (Mrs.) Archana Sharma
Professor M. M. Sharma
Dr H. L. Nigam
Professor A. K. Sharma
Dr Jagdish Shankar

Condolence at the Passing away of the following Fellows
Sir William Abraham, Brig. E. A. Glennie and Dr K. Subramanyam

The members condoled the passing away of Sir William Abraham, Brig. E. A. Glennie and Dr. Subramanyam, distinguished Fellows of the Academy, all present standing for two minutes in silence as a mark of respect to the deceased.

Confirmation of the Minutes of the Ordinary General Meeting held on 1 March 1980
Minutes of Ordinary General Meeting held on 1 March 1980 read by the Secretary, Dr A. P. Mitra were confirmed.

Confirmation of the Minutes of the Extraordinary General Meeting held on 22 April 1980
Minutes of the Extraordinary General Meeting held on 22 April 1980 read by Dr M. G. Deo, Secretary were confirmed.

Admission of Fellows under Rule 13
Professor M. M. Sharma introduced by Dr Jagdish Shankar was admitted to the Fellowship of the Academy and he signed the register.

To Report the Nomination of Dr A. Gopalakrishna for Consideration for Election to Fellowship under Rule 45(c)
Reported.

During the general discussion on popularisation of science that followed, it was suggested that the Academy may examine the question of assisting the publication of books for high school students in selected topics (of about 100 to 150 pages each) which should be nominally priced and the Academy may suggest a panel of names to the other publishing agencies like the NCERT, Childrens' Book Trust, etc. The President referred to the Biological Series Kit and Self-Evaluation Manual that are being made available to the students by the Australian Academy of Sciences. Lectures could be held under the auspices of local chapters for children and non-scientist adults. The school science programme which was very popular when conducted earlier could be revived in Delhi and other centres. Symposia by children may be considered. It was mentioned that the Science Workshop for students in Kerala was very popular but they felt a serious lack of audio-visual equipment. The students evinced great interest in courses in science. The question of conducting these courses and lectures in Indian languages should be examined.

Dr M. G. P. Stoker delivered a lecture on '*New Biology and Medicine*' in the Lecture Theatre at the Hotel Broadway, Srinagar. This lecture was organised by the Academy in collaboration with the Institute of Medical Sciences, Srinagar.

Sd/-
A. P. Mitra
Secretary
07/08/1980

Sd/-
V. Ramalingaswami
President
07/08/1980

NOTICE

The Officers of the INSA during their meeting on 7 June 1980 desired that the Academy should play a more dynamic role in the planning process for Development. Fellows of the Academy are requested to identify areas and prepare approach papers for the VI Five Year Plan and forward them to the Academy.

ANNOUNCEMENTS

The 'Nehru Centre,' Bombay has announced a reduction of 50 per cent in the annual subscription of the Centre's quarterly journal entitled *'Society and Science'* for the Fellows of INSA. The concessional rate will be Rs. 10/- per annum in place of Rs. 20/- per annum for four issues.

The Board of Research in Nuclear Sciences of the Department of Atomic Energy invites research proposals from scientists in Universities/ IITs and other research institutions for financial assistance in the field of Pure and Applied Mathematics. The support is usually given for a period of three years. For further information, Professor M. S. Raghunathan, Tata Institute of Fundamental Research, Bombay-400 005 may be contacted.

PUBLICATIONS OF THE ACADEMY

(For details please contact Associate Editor, INSA)

Proceedings

Part A (*Physical Sciences*), **Part B** (*Biological Sciences*)
Fist issued in 1935 as a single volume for both branches, split into two series in 1955.
Periodicity : Monthly (six issues of each part in a year)
Annual Subscription (including postage)
Inland : Rs. 120.00 (Rs. 60.00 per Part)
Foreign : £ 18.00 or $ 40.00 (£ 9.00 or $ 20.00 per Part)

Indian Journal of Pure and Applied Mathematics

Devoted primarily to original research in Pure and Applied Mathematics. First issued in January 1970
Periodicity : Quarterly up to 1971, bimonthly in 1972 and as a monthly journal from 1973.
Annual Subscription (including postage)
Rs. 250.00 (inland), £ 30.00 or $ 80.00 (foreign)
Single issue (including postage) Rs. 25.00 (inland ; £ 3.00 or $ 8.00 (foreign)

Biographical Memoirs of the Fellows of INSA

Contains memoirs on the deceased Fellows of the Academy. First issued in 1966 and priced individually.

Monographs

First issued in 1960 and priced individually.

Bulletins

Contain proceedings of the symposia. First issued in 1952 and are priced individually. The papers read at the symposium are now being published in the Proceedings also.

Popularisation of Science

Famous Plants by B. M. Johri & Sheela Srivastava. Rs. 7.50/$ 2.50.

Year Book

A hand-book on the origin, functioning, activities, and Rules & Regulations of the Academy. First issued in 1960 and is priced individually.

INSA Scientific Report Series

5 volumes have been published since 1978.

Special Publications

Use of Non-Human Primates in Biomedical Research (*Eds.* M. R. N. Prasad & T. C. Anand Kumar). Rs. 300.00 US $ 40.00 D.M. 100.00

Science and its Impact on Society—Indian experience Rs. 30.00 $ 10.00 & £ 5.00

Recent Publications

Basic Sciences and Agriculture (1978) Rs. 30.00 $ 10.00
Advances in Lunar Research — Luna-24 Samples (1979) Rs. 30.00 $ 10.00
Hormonal Steroids in Fish 1980 Rs. 30.00 $ 10.00

PUBLICATIONS OF THE NATIONAL COMMISSION FOR THE COMPILATION OF HISTORY OF SCIENCES IN INDIA

Indian Journal of History of Science

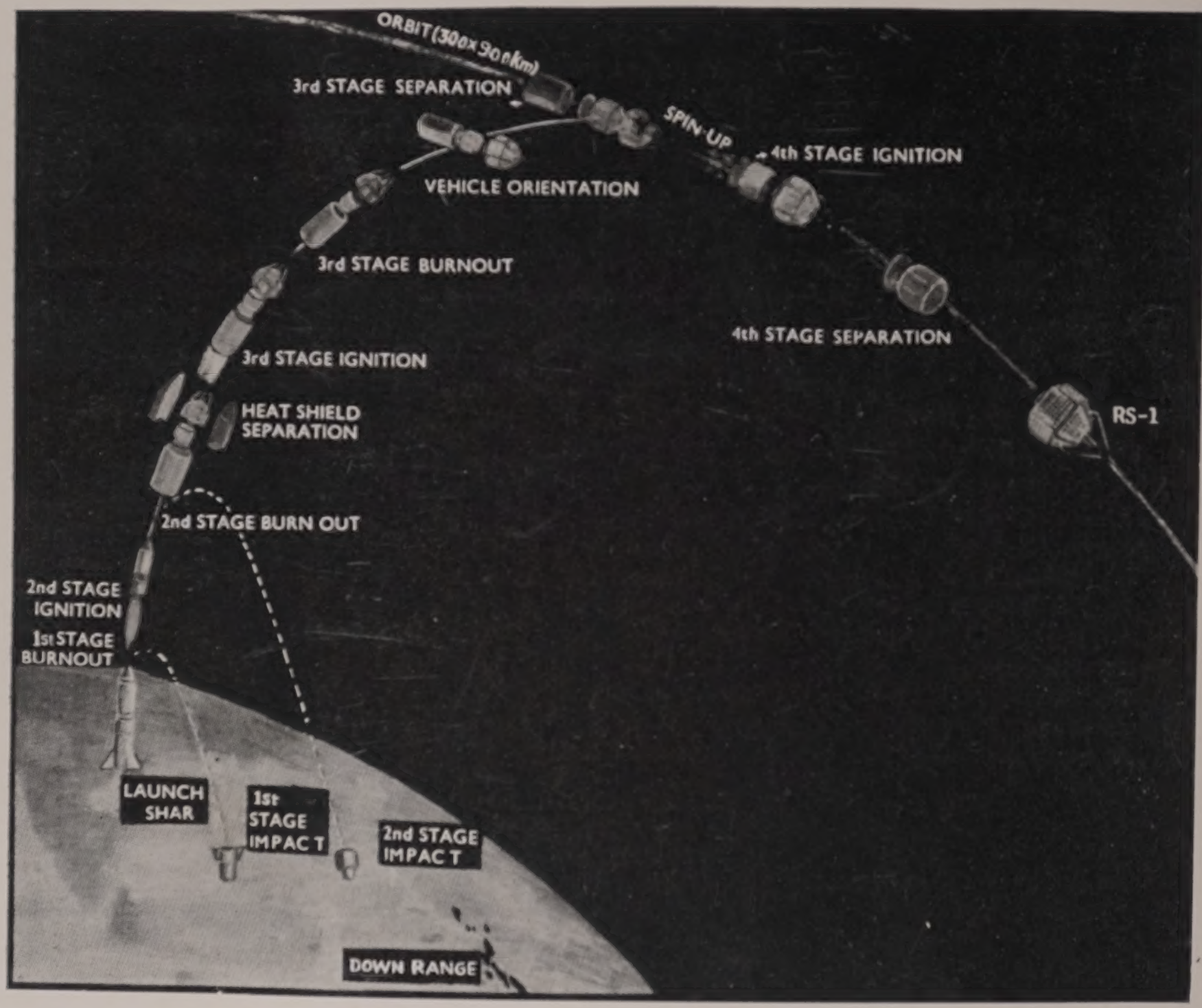
First issued in 1966. Periodicity : Bi-annual
Annual Subscription (inclusive of postage) : Rs. 30.00 (inland); £ 3.00 or $ 8.00 (foreign)
Single issue : Rs. 20.00 (inland); £2.00 or $5.50 (foreign)

Books

A Bibliography of Sanskrit Works on Astronomy and Mathematics by S. N. Sen .. Rs. 20.00; $5.00; 35s.
Fathullah Shirazi—A Sixteenth Century Indian Scientist by M. A. Alvi and A. Rahman .. .. Rs. 2.50; $0.33; £0.2*s* 9*d*.
Jahangir—The Naturalist by M. A. Alvi and A. Rahman .. .. Rs. 20.00; $3.60; £1.10*s*.
Some Aspects of Prehistoric Technology in India by H. D. Sankalia .. Rs. 10.00; $2.50; £1.00
A Concise History of Science in India edited by D. M. Bose, S. N. Sen and B. V. Subbarayappa .. .. Rs. 50.00; $16.00; £6.00

Note : The second edition of another prestigious publication *Charaka Samhita* is in print.

FLIGHT SEQUENCE



Courtesy : ISRO

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